TRANSLATION OF ANNEXES TO IPER

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Arrangement for protecting an electrical device

The present invention relates to an arrangement for protection of an electrical device.

A large number of electrical and electronic components which may be damaged if subjected to polarity reversal are used in a large number of applications of electrical devices, in particular in vehicle power supply systems, for example in controllers. By way of example, electrolytic capacitors can be destroyed explosively if polarity reversal is applied. Furthermore, semiconductor power switches based on MOSFETs allow a high current to flow via their inverse diode if connected with inverse polarity, with this inverse diode being present in normal MOS transistors or MOS drivers. This undesirable high current flow can lead to destruction of the respective switch and/or to a load being unintentionally switched on. Bridge circuits are particularly critical in this context.

The use of electrolytic capacitors and semiconductor elements is, however, becoming increasingly important, especially in motor vehicle power supply systems. By way of example, electric motors are increasingly being subjected to open-loop or closed-loop control by means of pulse width modulation, for which purpose high switching frequencies are required which can be provided with the aid of semiconductor switches. Electrolytic capacitors are used in these applications in order to avoid damaging reactions on the vehicle power supply system.

element. The collector of the bipolar transistor is connected to a positive pole terminal of a vehicle battery, while the emitter of the bipolar transistor is connected to the trigger. The base of the bipolar transistor is connected to the cathode of a diode, whose anode is connected via a resistance to a negative pole terminal of the vehicle battery, to which the trigger is also connected. In the event of polarity reversal, the bipolar transistor is operated in the inverse mode since in this case the voltage drop across the collector-emitter path of the transistor is at a minimum. This allows the trigger to be supplied with a sufficiently high current even when there is a small negative voltage across the limiting element. This arrangement is also comparatively complex.

DE 100 47 791 A discloses an arrangement for polarity-reversal protection in a motor vehicle. In this case, a connecting section is connected to the positive pole of the vehicle power supply system and/or to the battery. This connecting section and an external starting pole are connected electrically in series by means of an intermediate closed relay contact when external starting is being carried out with the correct polarity. If, in contrast, an external voltage source is connected to the external starting pole with the incorrect polarity, the relay contact remains open.

DE 199 22 332 C discloses a safety device for vehicles, by means of which the battery, the vehicle power supply system and further electrical components such as the starter and generator are intended to be protected. For this purpose, switching logic drives a motor switch as a function of received signals, with the various switch positions of the motor switch allowing the electrical potential at one battery pole also to be applied to the

vehicle power supply system connection, to the starter or the generator, or to an external starting assistance support point.

The present invention is concerned with the problem of specifying an improved embodiment for a protective arrangement of the type mentioned in the introduction, which can in particular be implemented at low cost and ensures particularly good protection for the respective electrical device.

According to the invention, this problem is solved by the feature combination of claim 1. Advantageous embodiments are the subject matter of the dependent claims.

The invention is based on the general idea, of arranging a switch directly adjacent to a pole terminal between a connecting section, which is connected to the pole terminal, and a starting assistance contact section which can make contact with a jumper cable in order to provide and receive starting assistance, which switch disconnects the electrical connection between the starting assistance contact section and the connecting section as soon as an evaluation circuit detects a fault current. It is particularly important in this case that the electrical device is connected to the pole terminal separately, that is to say bypassing the switch. If the polarity is incorrect, a fault current flows which the evaluation circuit identifies, so that it operates the switch in order to disconnect the electrical connection between the starting assistance contact section and the connecting section. The incorrect-polarity starting assistance contact section is then immediately disconnected from the pole terminal, and thus from the respective device.

In consequence, the fault current does not reach the device at all. An arrangement such as this can be implemented at low cost and is thus particularly suitable for large scale production use. It is also particularly important for the device to still be connected to the pole of the battery, and thus still to be operable, after the switch has been opened.

According to claim 1, the main line leads to at least one second electrical device, for example to a starter and a generator or to a starter generator, and is connected to the starting assistance contact section, in which case the first device, for example a vehicle power supply system, is then connected to the pole terminal, bypassing the main line.

This refinement makes it possible to allow different current flow directions in the main line for specific operating states without this leading to operation of the switch.

In one expedient development, the evaluation device can interact with a current sensor, which senses the current level and/or the current flow direction in a main line and is connected to the evaluation circuit in order to transmit a corresponding sensor signal. During starting, a starting signal transmitter produces a start signal and is connected to the evaluation circuit in order to transmit this start signal. The evaluation circuit can now use the sensor signal and the start signal to detect whether or not a fault current is present and, if appropriate, to open the switch as soon as it detects a fault current in the main line. This design makes it possible, for example, to protect a vehicle power supply system against damage when an attempt is made, for example, to use a vehicle with a

24 volt power supply system to provide starting assistancefor a vehicle with a 12 volt vehicle power supply system.

For example, the current flows in one direction through the main line during normal driving operation of the vehicle, that is to say during generator operation, while the current flows through the main line in the opposite direction during starting of the vehicle, that is to say during starter operation. The additional start signal is provided in order to ensure that the evaluation circuit does not assess the current flowing in the opposite direction as indicating reversed polarity.

According to one particularly advantageous development, the current sensor can be arranged on the main line in such a way that the starting assistance contact section is located between the current sensor and the switch. Fundamentally, the point at which the current sensor is arranged between the pole and the starter and/or generator along the main line is irrelevant for the current sensor. However, the arrangement according to the invention makes it possible for a vehicle which is equipped with the protective arrangement according to the invention to provide starting assistance for another vehicle. This is because the chosen arrangement